REMARKS

By the present amendment and response, claims 1, 9, 26, and 35 have been amended to overcome the Examiner's rejections. Claims 1-2, 4-9, 17-22, 26-29, and 31-37 are pending in the present application. Figures 2 and 11 through 14 have been amended. The specification has also been amended. Reconsideration and allowance of pending claims 1-2, 4-9, 17-22, 26-29, and 31-37 in view of the above amendments and following remarks are requested.

A. Objection to the Drawings

The Examiner has objected to the drawings

> "as failing to comply with 37 CFR §1.84(p)(4) because reference characters '22A' and '22B' have been used to designate both active regions (see page 5, line 18) and a layer between FOX regions 21A, 21B and 21C, which seems to be an oxide layer."

The Examiner has further objected to the drawings

> "as failing to comply with 37 CFR §1.84(p)(4) because reference characters '111A' and '111B' have been used to designate both a 'dual' nitride spacer (see fig. 11) and a single nitride spacer over a base oxide 71 (see fig. 12)."

Two paragraphs of the specification have been amended to correct a clerical error. The attached replacement sheets of drawings include changes to Figure 2 and Figures 11 through 14 (Figures 11 through 14 were previously amended in the response to the Office

Action dated April 2, 2002). The attached replacement sheets, which include Figures 1, 2, and 11 through 14, replace the original drawing sheets which also included Figures 1, 2, and 11 through 14. Figure 1 has not been amended. In Figure 2, the lead lines for reference numerals 22A and 22B have been elevated and given arrowheads, to indicate that 22A and 22B correspond to active regions, not layers. Reference numerals 19 have been added, which correspond to a well oxide layer. In Figures 11 through 14, the lead lines for reference numerals 111A and 111B have been modified such that they now have arrowheads clarifying that 111A and 111B each represent a set of dual nitride spacers, and not merely a single nitride spacer. The other amendments made in the response to the Office Action dated April 2, 2002 to the material between 21B and 21C in Figures 11 through 14 have been retained.

B. **Rejection of Claims 1-2, 4-9, 17-22, 26-29, and 31-37 under 35 USC §112**

The Examiner has rejected claims 1-2, 4-9, 17-22, 26-29, and 31-37 under 35 USC §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

The Examiner has stated:

> "Regarding claims 1, 9, 26, and 35, the limitations of forming a first implant having said first conductivity type and forming a second implant having said second conductivity type are confusing since it is not clear whether the terms first and second conductivity types refer to two regions having the same impurity types (e.g. two regions having either N- or P- type impurity) but different dopant concentrations (i.e. one region having P- and

another P+) or two regions having different conductivity types (i.e. one region of N- type and another of P- type). Clarification is required."

The Examiner has rejected claims 2, 4-8, 17-22, 27-29, 31-34, and 36-37 due to their dependency on independent claims 1, 9, 26, and 35.

In response to the Examiner's request for clarification, Applicant respectfully submits that independent claims 1, 9, 26, and 35 recite that the first implant has a first conductivity type and not a second conductivity type (of course, it may possible for the first conductivity type to be equivalent to the second conductivity type in one exemplary embodiment).

Nevertheless, Applicant wishes to clarify independent claims 1, 9, 26, and 35, which should be given their broadest reasonable interpretation. As stated in the present application at page 6, line 24, "[s]hallow base implant 101 comprises P-type ions" in one exemplary embodiment. As further stated in the present application at page 7, line 2, "[d]eep base implant 102 comprises P-type ions" in one illustrative embodiment. Therefore, in one embodiment, "conductivity type" refers to the type of impurity (N-type or P-type). For example, the first implant and the second implant are both of P-type conductivity in the embodiment disclosed at page 6, line 24 of the present application. However, in an alternative embodiment, the first implant and the second implant could be of opposite conductivity types. In yet another embodiment, "conductivity type" could refer to the dopant concentration (e.g., P+, P-, N+, or N-). Again, the claims should be given their broadest reasonable interpretation.

As a result, Applicant respectfully requests that the rejection of claims 1-2, 4-9, 17-22, 26-29, and 31-37 under 35 USC §112, second paragraph be withdrawn.

C. **Rejection of Claims 1-2, 4-9, 17-22, 26-29, 31-32, and 33-37 under 35 USC §103(a)**

The Examiner has rejected claims 1-2, 4, 6-7, 9, 17-18, 20-21, 26-29, 31, and 33-37 under 35 USC §103(a) as being obvious over U.S. Patent Number 5,854,117 to Huisman, et al. ("Huisman") in view of U.S. Patent Number 4,868,134 to Kasahara ("Kasahara"). The Examiner has rejected claims 5, 8, and 32 under 35 USC §103(a) as being obvious over Huisman in view of Kasahara, and further in view of IBM Corporation (NN79013241), "Determination of Doping Profiles by Means of SIMS," IMB Technical Disclosure Bulletin, 1979, Vol. 21, Issue Number 8, pp. 3241-3242 ("IBM"). The Examiner has rejected claims 19 and 22 under 35 USC §103(a) as being obvious over Huisman in view of Kasahara, and further in view of Wiedmann.

For the reasons discussed below, Applicant respectfully submits that the present invention, as defined by amended independent claims 1, 9, 26, and 35, is patentably distinguishable over the cited art.

As highlighted in the present application, the present invention relates generally to a method of fabricating a varactor diode on a semiconductor substrate. Specifically, the present invention relates to a method for fabricating high quality factor (Q), high tuning range diodes having a double base implant. Typically, known varactor systems employ a

single implant. A reason for employing a single implant is that, typically, double-implant processes do not provide a method for creating varactors having high capacitance densities, high capacitance tuning ranges, low leakage currents, and high Q values. The present invention achieves an advance in the art by providing a method and structure for a new varactor design that overcomes these and other problems of the prior art.

Turning to the present application at Figure 10 and page 6, lines 23-24, shallow base implant 101 (first implant) is formed. Shallow base implant 101 comprises P type ions. Referring to Figure 10 and page 7, lines 1-3:

> "A deep base implant 102 [second implant] is then formed using standard ion implantation techniques. Deep base implant 102 comprises P-type ions . . . implanted into epitaxial layer 13 such that deep base implant 102 is disposed below shallow base implant 101."

Referring to Figure 10 of the present application, it is readily apparent that deep base implant 102 extends into epitaxial layer 13 a greater distance than shallow base implant 101 extends into epitaxial layer 13. Moreover, deep base implant 102 has a depth that is more than twice the depth of shallow base implant 101.

Advantages of the invention, some of which were discussed above, result from the invention as disclosed and claimed. However, to further define the invention and its differences and advantages, Applicant has amended independent claims 1, 9, 26, and 35 to recite that "said second implant has a depth that is more than twice a depth of said first implant."

In contrast, Huisman relates to a method of manufacturing a varicap diode. Huisman simply teaches "first zone 3 provided in the third zone 7 through implantation of arsenic atoms." Huisman, column 4, lines 64-65. Huisman further teaches a PN junction being formed between the second zone and the first zone. (Huisman, Abstract.) Huisman does not teach, disclose, or suggest the second implant being more than twice the depth of the first implant. (Huisman, Figure 2.) Therefore, Huisman does not teach, disclose, or suggest the present invention as defined by amended independent claims 1, 9, 26, and 35, nor does Huisman achieve some of the advantages of the present invention discussed above. Kasahara, IBM, and Wiedmann do not cure these deficiencies.

For the foregoing reasons, Applicant respectfully submits that the present invention as defined by amended independent claims 1, 9, 26, and 35 is not taught, disclosed or suggested by Huisman in view of the cited art. Thus, amended independent claims 1, 9, 26, and 35 are patentably distinguishable over the cited art. As such, the claims depending from amended independent claims 1, 9, 26, and 35 are, *a fortiori*, also patentably distinguishable over the cited art for at least the reasons presented above and also for additional limitations contained in each dependent claim.

Accordingly, it is respectfully submitted that amended independent claims 1, 9, 26, and 35 and their respective dependent claims are patentably distinguishable over the cited art and should be allowed.

D. **Conclusion**

Based on the foregoing reasons, the present invention, as defined by amended independent claims 1, 9, 26, and 35, and the claims depending therefrom, is patentably distinguishable over the art cited by the Examiner. Thus, claims 1-2, 4-9, 17-22, 26-29, and 31-37 pending in the present application are patentably distinguishable over the art cited by the Examiner. As such, and for all the foregoing reasons, an early Notice of Allowance of claims 1-2, 4-9, 17-22, 26-29, and 31-37 pending in the present application is respectively requested.

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